

BEE-KILLING ROBBER FLIES

BY S. W. BROMLEY, M.Sc.

BARTLETT TREE RESEARCH LABORATORIES, STAMFORD, CONN.

ABSTRACT

Certain robber flies frequently feed on honey bees and have been known as "bee-killers." In North America, *Promachus fitchii* O. S. and in the Argentine, *Mallophora ruficauda* Wied. have been recorded as causing losses to bee-keepers. In the United States five genera, *Stenopogon*, *Deromyia*, *Promachus*, *Mallophora* and *Proctacanthus*, contain species which commonly kill bees, while two genera, *Bombomima* and *Erax*, contain species which occasionally do so. A control measure is suggested in the rare cases where economic losses are caused.

That so defenseless an insect as a fly should be able to overcome and devour so formidably defended an insect as a bee is a matter of considerable interest. Yet certain robber flies frequently kill bees and have even caused economic losses to bee-keepers. The present paper will be limited for the most part to those species in which this activity has been noted.

It was in Europe where the bee-feeding habit was first noted, but little economic importance has been attached to the habit there. Robineau-Desvoidy was one of the first to remark upon the killing of bees by robber flies. In 1836, he called attention to the fact that *Selidopogon diadema* Fabricius frequently chose the honey bee for its prey. In more recent years, two writers, Poulton and Sarel-Whitfield, have recorded European species feeding on honey bees.

SPAIN. Poulton (1906) found *Selidopogon diadema* Fabricius feeding extensively on the honey bee. He also took a species of *Machimus* (probably *chrysitis*) and another species near *setibarbis* preying on honey bees.

ENGLAND. Sarel-Whitfield (1925) has recorded *Asilus crabroniformis* Linn. as feeding on the honey bee.

INDIA. Poulton (1906—quoting T. B. Fry, 1902) lists *Laxenecera flavibarbis* Macq. as feeding on the small Indian honey bee (*Apis florea*). Walker gave the name *apivorus* to a species of *Promachus* from Burma because it was reported as feeding on the large black bees.

AFRICA. Poulton (1906—quoting Marshall, 1902) lists a species of *Promachus* near *guineensis* with the African form of the honey bee. In a collection of Asilidæ sent me by Mr. H. K. Munro of Pretoria, South Africa, two species were present with honey bees in their grasp. These were *Promachus vagator* and a large undetermined species of *Neolophonotus*. Dr. von Someren of Nairobi, Kenya Colony, reporting to Professor Poulton (1924) on the habits of *Hyperechia bifasciata* Grünb. and *H. imitator* Grünb. mentioned that he has noted them feeding on *Apis mellifera adansoni*.

ARGENTINA. *Mallophora ruficauda* Wied. abounds in the plantations about Buenos Aires and is recorded by Copello (1922 and 1927) as a particular enemy of the honey bee.

CUBA. *Mallophora maquartii* Rondani is abundant in Cuba and feeds largely on honey bees where these are available (Bromley—quoting Bruner, 1929).

NORTH AMERICA. The first writer to report the bee-killing habits of these flies in North America was Dr. Asa Fitch, who in 1864 described the “Nebraska bee-killer,” *Trupanea apivora*, now known as *Promachus fitchii* O. S. The specimens from which Fitch’s descriptions were made were received from R. O. Thompson, Esq., Florist and Nurserymen, Nursery Hill, Otoe County, Neb., together with a note dated June 28, 1864, stating that the insects were destructive to honey bees and rose bugs. A later communication from Mr. Thompson gave further information on the habits of the fly.

“My attention was first called to this fly destroying the honey bee by a little boy, a son of D. C. Utty, Esq., of this place. After sending you the specimens I watched its proceedings and habits with much care, and find that, in addition to the honeybee and rose bugs, it devours many other kinds of beetles, bugs and flies, some of which are as large again as itself. It appears to be in the months of June and July that it is abroad upon the wing, destroying the bees. None of them are now (August 2d) to be seen. When in pursuit of its prey it makes quite rapid dashes, always capturing the bee on the wing. When once secured by wrapping its legs about it, pressing it tightly to its own body, it immediately seeks a bush or tall weed, upon which it alights and

commences devouring its prey by eating (piercing) a hole into the body and in a short time entirely consuming it (sucking out the fluids and soft internal viscera) and leaving only the hard outer skin or shell of the bee. Upon the ground beneath some favorable perch for the fly near the apiary, hundreds of these shells of bees are found accumulated in a single day—whether the work of one fly or of several I am not able to say. I have just returned from a professional tour through the northern portion of our territory, taking Nursery orders; and in many things this business and the apiary are closely connected. In no case have I found a hive of bees that has thrown off a swarm this season! The dry weather, a bad pasture and other reasons were assigned as the cause. But many persons, since they have found this fly at his work of destruction, now believe it to be the cause of the non-swarmering of their bees; and I am led to the same opinion. I have only to add further, that this bee-killer delights in hot, dry weather, and is very invulnerable and tenacious of life." A good illustration of the insect is given in Fitch's report and the description leaves no doubt as to its identity.

This fly was also mentioned by C. V. Riley in his first Annual Report on the Noxious, Beneficial and Other Insects of Missouri, page 168 (1869). Dr. Fitch's correspondent, Mr. Thompson, had moved to Missouri where he met Riley and informed him that he had found the fly in increasing numbers every year since 1864 when his report to Fitch had been made. In 1868, he reported that it had made its appearance in such numbers in Northern Missouri as to prevent to a great extent bees from swarming. In the *Rural World*, September 12, 1868, he stated that he had watched one individual and found that it destroyed no less than 141 bees in a single day.

In his second Annual Report, page 121, 1870, Riley again refers to this fly, stating that it was the same as *Promachus bastardi*, an error which persisted to the extent that in most of the subsequent references to the Nebraska bee-killer the name *Promachus bastardi* has been used. Riley described in this report another robber fly taken with honey bees, giving it the name *Asilus missouriensis* or the Missouri bee-killer. This species was subsequently identified as *Proctacanthus milbertii* Macquart.

Riley stated that this species "acts in the same manner as the Nebraska Bee-killer, being, if anything, more inhuman and savage."

In the Bee-Keepers' Guide (1894—Fifteenth Edition—page 414) Professor A. J. Cook gives robber flies prominence as enemies of bees. He mentions *Asilus missouriensis* Riley (= *Proctacanthus milbertii* Macquart) but also notes that in Michigan "this species has been observed to kill the cabbage butterfly by scores." He next mentions an *Erax* from Louisiana (*Erax interruptus* Macquart, I judge by the figure) and the "Nebraska bee-killer" (for which he erroneously used the name *Promachus bastardi* Macquart).

A more detailed description of the so-called "Southern bee-killers" (*Mallophora orcina* Wiedemann and *M. bomboides* Wiedemann) was then given. The most common was noted as *M. orcina* occurring in Tennessee, Georgia and Florida. Cook states that "the habits of the flies are interesting, if not to our liking. Their flight is like the wind, and perched near the hive, they rush upon the unwary bee returning to the hive with its full load of nectar, and grasping it with their hard strong legs, they bear it to some perch nearby, when they pierce the crust, suck out the juices, and drop the carcass, and are then ready to repeat the operation. A hole in the bee shows the cause of its sudden taking off. The eviscerated bee is not always killed at once by this rude onslaught, but often can crawl some distance away from where it falls, before it expires." The latter observation I have never been able to verify. In all cases, that I have observed, the victim is killed almost immediately at the initial piercing of the fly's beak. In addition, Cook mentions "the *Laphria thoracica* of Fabricius" (*Bombomima thoracica* Fabricius) as occurring in Georgia and having the same bee-killing habits.

THE BEE-KILLING GENERA OF THE U. S.

In this country, the bee-killing species occur principally in seven genera, namely, *Stenopogon*, *Deromyia*, *Bombomima* (*Dasyllis*), *Promachus*, *Mallophora*, *Proctacanthus* and, occasionally, *Erax*. We shall consider the species involved under their separate subfamilies.

Leptogastrinæ

No member of this subfamily is known to kill honey bees.

Dasypogoninæ

Bee-killing species of this subfamily in the United States occur in the genera *Stenopogon* and *Deromyia*, although it is quite probable that the larger species of *Saropogon* such as *S. combustus* Loew and *S. dispar* Coquillet may also kill honey bees. The two species of *Microstylum* to which belong our largest Asilids occur from Mexico to Kansas but are rare, and little is known of their feeding habits. Those taken with prey had killed large grasshoppers.

Stenopogon. Two species of this genus, *S. obscuriventris* Loew. and a closely related, apparently new, species are very abundant in Southern California. Both species were either observed or taken with prey on many occasions by the writer and the majority of the species captured were worker honey bees. Another apparently new species, related to both the above mentioned, but distinct from either, was found preying on honey bees in Central California.

Deromyia. Probably most of the larger species of this genus will kill honey bees. The habit has been definitely observed in the following species—*umbrina*, *discolor*, *angustipennis* and *symmacha*.

D. rufescens and a new species, common in the southeast, hitherto known as *D. bilineata* Loew, have been taken with worker bumble bees, and both of these species no doubt feed on honey bees when occasion offers.

The species of this genus are rather slender, bare, fragile-appearing robber flies with long and slender but strong legs. When seizing a bee or other large prey, they hold it off at "arm's length" rather than press it tightly to their own bodies as do the species of *Promachus* and *Mallophora*. Flying to a weed or low bush, the *Deromyia* suspends itself from one of the front legs while with the others it manoeuvres its prey into a position favorable for inserting its beak. Less protected by bristles and coarse hairs than the two bee-killing genera above mentioned, *Deromyia*

probably employs this method for protection against the stings of its aculeate victims.

Deromyia umbrina Loew. This common red robber fly of the Northeastern States occurs from mid-July until October along country roadsides, and around the edges of fields and meadows where goldenrod, asters, joe-pye weed and wild carrot are blooming in profusion. It flies with a loud, rather high-pitched hum and feeds largely on honey bees, bumble bees, yellow jackets (*Vespa communis*, *diabolica* and *vidua*) and other *Hymenoptera*. It also preys on other Diptera, particularly *Eristalis*, tachinids and other flies occurring about flowers. Occasionally, I have taken it with a flower beetle or a tree hopper and rarely with a small damsel fly (*Ischnura verticalis*). I have never seen it capture or attempt to capture a butterfly or a grasshopper. In Massachusetts where most of my observations on this species were made, I believe that it kills more honey bees than any other Asilid there. This is due to the fact that it practically limits itself to a Hymenopterous diet, is abundant, generally distributed and occurs where bees are most likely to be found, namely, around flowers.

The overcoming of a mud-dauber wasp (*Sceliphron cementarium*) or a brown wasp (*Polistes pallipes*) appears to be about the limit of its powers so far as Hymenoptera are concerned. The larger and more powerful wasps, such as the white-faced hornet, are too strong for it. In fact, I once saw a white-faced hornet attack and overcome one of this species.

Deromyia discolor Loew. This pale, inconspicuous species occurs throughout the Central States, assuming much the same position as a bee-killer in this region as *D. umbrina* occupies in New England. It occurs in fields and around the edges of woods in somewhat the same habitats as those occupied by *D. umbrina* further north. It is, however, lighter-colored, less robust and flies with a rather weak, drifting flight accompanied by a low dull buzz. Its appearance in the field suggests that of a Hymenopterous insect, such as a *polistes* or large ichneumonid. It is an avid feeder on honey bees and yellow-jacket workers. All feeding records I have for it are Hymenoptera with the exception of one, where the victim was an Asilid fly of the same genus, *D.*

misellus Loew. (hitherto known as *wintheni* Wied., a South American species quite distinct from *misellus*). Marlatt, years ago (1893), called attention to *discolor* feeding on yellow-jackets (*Vespa communis* and *V. carolina*) in Maryland. Later, Banks (1913) recorded it under the name of *D. ternata* as feeding on *Vespa* and also honey bees; while McAtee and Banks (1920, page 20) listed it as feeding on several species of Hymenoptera, including the honey bee and yellow-jackets.

D. angustipennis Loew. This species, quite closely related to the following but distinguished from it by its smaller average size, comparatively more robust appearance, darker wings and darker thoracic markings, appears to be quite common in certain parts of Kansas, where it has been found preying on the honey bee.

D. symmacha Loew. A light-colored species common in Kansas and Texas. It is quite variable in size and large individuals have frequently been identified as *D. bigoti* Bellardi. My determination of *bigoti* is a large Mexican species, darker in color and with dark yellowish wings. Bellardi's specimen was from Mexico. *Symmacha* has been taken feeding on honey bees and also large wasps, such as *Polistes*, *Sphex* and *Psammocharids*.

Laphriinae

This sub-family contains one genus in North America known to kill honey bees, *i.e.*, *Bombomima* Enderlein, formerly termed *Dasyllis*. The true *Dasyllis* is a neotropical genus, entirely unlike our North American species which are closely related to *Laphria*. *Dasyllis* is closely related to the old world genus *Hyperechia* (which frequently take as prey large aculeate Hymenoptera) and its nearest allies in North America are *Andrenosoma* and *Pogonosoma*. The larger species of the two last genera in this country are Hymenoptera feeders and probably kill honey bees.

The species of *Bombomima* are more robust and hairy than the average Asilid and many of them quite closely resemble bumblebees. Both *Bombomima* and the asiline genus *Mallophora*, our two bumble-bee-resembling genera, seem to prefer as prey insects of the "buzzing" rather than the "fluttering" type of flight, but

Bombomima prefers Coleoptera, while *Mallophora* is more partial to Hymenoptera. *Bombomima* will, however, occasionally select Hymenoptera for prey and two species, *B. thoracica* Fabricius and *B. grossa* Fabricius, have been implicated in bee-killing.

Bombomima thoracica Fabricius. This bumble-bee-like species is found in early summer throughout eastern United States along the sunny edges of woods or brushy pastures and in the vicinity of logs and stumps in which the immature stages undergo their development. It has been reared from a pine stump and I have noted the adults about elm, maple and birch logs and stumps. I have frequently taken the adults with beetles in their grasp; the rose beetle, *Macrodactylus subspinosus*, and the dung beetle, *Aphodius fimetarius*, most commonly. Although I have never myself taken it with a honey bee, I have two such records; one from near New York City and one from Lancaster, Pa., and I have on at least one occasion noted it with a solitary bee (*Halic-tus*) as prey. Messrs. Champlain and Guyton of Harrisburg, Pa., showed me a specimen in August, 1927, that had recently been sent in by a bee-keeper with the information that it had been caught killing bees. Cook (1894) recorded this species as killing bees in Georgia.

Bombomima grossa Fabricius. This species also bears a resemblance to bumble-bees, but is considerably larger and stronger than the preceding. It occurs from New England to South Carolina and has been recorded from Florida. Its habitats are much the same as those of *thoracica*. It seems to prefer, however, larger stumps and logs, being particularly partial to elm. Its prey averages much larger than that of *thoracica*. Champlain and Knull (1923) recorded it as capturing a large cicada. I have taken it with, among other prey, the carrion beetle, *Silpha americana*, the rove beetle, *Staphylinus vulpinus*, and the bumble-bee, *Bombus vagans*. One specimen in the National Museum bears the label "feeds on honey bees."

Asilinæ

To this sub-family belongs the majority of our more important bee-killers. These include the genera, *Promachus*, *Mallophora*.

Proctacanthus and occasionally *Erax*. I have no records of any of the genus *Asilus* (*sensu lato*) feeding on the honey bee in this country, although in Europea *Asilus crabroniformis* Linn. is reported as so doing. The genus *Erax* contains many rather large and powerful species in the southwest and it would not be at all surprising to discover bee-killing proclivities in other than the three species mentioned in the present writing.

Promachus. Probably all of our species of *Promachus* will prey on the honey bee if opportunity is given. The species known definitely to prey on honey bees are *fitchii*, *bastardi*, *rufipes*, *vertebratus* and *princeps*.

Promachus fitchii O. S. The "Nebraska Bee-killer." This was the first species of bee-killing habits in this country to which attention was called. Its habitat seems to be quite restricted, although its range is wide, including most of the Middle West, New York and New England. It has also been recorded from Florida. I have never found it except in rather dry hay fields and wheat fields, where it alights on stalks of grass or weeds and on timothy, daisy or clover heads in which the females are often seen to oviposit. While other species are found more frequently around the edges of the fields, this seems to prefer the center, but individuals are generally well distributed throughout the field in which they occur. In a favored field, this species is likely to be found in enormous numbers. I have seen localities in Missouri and Massachusetts where one might stand in the center of a field and by a wave of the hat start up the species by the dozen, the high-pitched shrill buzz of the flies taking flight filling the air on all sides. Felt (1912-1916) has shown that the larva of this species is predaceous on that of *Phyllophaga fusca* and possibly other species of white grubs. It is quite probable that their numbers fluctuate with the number of white grubs in a given territory and the prevalence of the adult fly in certain types of fields is no doubt explainable on this basis.

In addition to honey bees, solitary bees (*Halictus*, *Agapostemon*, etc.) are frequently taken as are Diptera, small Coleoptera and Hemiptera, particularly pentatomids and reduviids, such as *Sinea* sps. It seems to prefer insects of the "buzzing" rather

than the "fluttering" type of flight, although it will sometimes kill small grasshoppers.

Promachus bastardi Macquart. The false "Nebraska bee-killer." This is a common and widely distributed species throughout Central, Eastern and Southern United States. It is of about the same size as *fitchii*, but is darker brown in color as well as differing in other and more important characteristics. It was confused by Riley and other writers with *fitchii*. *Bastardi* has the same high-pitched buzz characteristic of the true "Nebraska bee-killer," but differs somewhat in habitat. *Fitchii* is found in the center of fields, while *bastardi* is found more characteristically around the edges of fields, along roadsides, overgrown walls, and fences, and in brushy pastures and similar locations, where it alights on twigs, posts, stones or tall weeds. The type of insects chosen for prey is quite similar to that of *fitchii*.

Promachus rufipes Wiedemann. The "Bee-Panther." This species is quite common in many parts of the South. It is the largest of its genus east of the Mississippi. It occurs in late summer in habitats that are characteristic of *Deromyia umbrina* further north, *i.e.*—along the moist edges of fields, roads or woods where golden-rod, joe-pye weed, asters and other herbaceous plants bloom in profusion. *Rufipes* is a bee-killer par excellence and in these flowery haunts of bees, it may be found feeding on honey bees, bumble-bees, solitary bees and wasps, varying its diet with syrphid, tachinid or other asilid flies. (*Erax rufibarbis* and *Mallophora clausicella* have been taken from this species.) I have also taken it with the leaf-footed plant bug (*Leptoglossus phyllopus*). In some parts of the South, its bee-killing habits have been noted by apiarists, who have termed it the "bee-panther."

Promachus vertebratus Say. There are specimens of *Promachus vertebratus* Say in the National Museum bearing the label "feeding on honey bees." I found the species abundant in the wheat and hay fields of northern Missouri along with *P. fitchii*, but occurring more commonly along the "draws" and moister parts of the fields. A few were to be found in the center of the fields, also, where *fitchii* occurred in great numbers. I

did not find any preying on honey bees, although *fitchii* was seizing honey bees right and left in the same fields. The prey of *vertebratus* seemed to average larger than that of *fitchii*. I found them in several instances with large stink bugs (*Euschistus* sps.) and very frequently with grasshoppers (*Melanoplus atlantis* and others). In some cases, the grasshoppers were more bulky than the fly itself and in one case the captor was unable to fly with its victim due to its size. Le Conte (1850) described the attacks of this species on cicindelids. Walton (1922) figures it (page 12, figure 16) as an enemy of grasshoppers. Washburn (1905, page 87) states that he has seen this species flying over a wheat field with a good-sized grasshopper in its grasp. Adams (1915) found it feeding on *Euschistus*. Evidently, the species is more of a grasshopper feeder and less of a honey bee feeder than *fitchii*.

Promachus princeps Williston. The only feeding record I have of this species is one from Washington taken with a worker honey bee.

Mallophora. *Mallophora* is undoubtedly an American offshoot of the cosmopolitan genus *Promachus*. The bee-killing habit of the latter genus occurs also in *Mallophora* where it has become even more fixed and specialized. Generally speaking, members of this genus prefer aculeate Hymenoptera for prey, and—even more remarkable—many of the species closely resemble in appearance bumble-bees and other bees, being much more robust than the average Asilid. All of our larger North American species kill honey bees. In Argentina, *M. ruficauda* Wiedemann is a distinct enemy of honey bees (Copello, 1922 and 1927), while the common Cuban species, *M. macquarti* Rondani, has the same habits.

Mallophora orcina Wiedemann. The "Southern bee-killer." This bumble-bee-like species is frequently met with in most parts of the South, occurring during the middle of summer in old fields and around the edges of corn and cotton fields, flying with a deep, dull hum and alighting on the stalks of weeds or low brush. I have never seen it kill or have I any record of its killing anything but Hymenoptera. It frequently seizes honey bees. Marlatt (1893) records this species as an enemy of yellow-

jackets (*Vespa communis* and *V. carolina*) in Maryland, while McAtee and Banks (1920, page 28) have listed among its prey "the bumble-bees, *Bremis impatiens*, *B. affinis* and *B. pennsylvanicus*, and the wasps *Polistes pallipes*, *Vespula vulgaris* and *Dolichovespula maculata*." Mr. C. T. Greene of the National Museum informs me that it is fairly common in the environs of Washington, D. C., where it feeds extensively on yellow-jackets, striking them in mid-air with an audible impact. Mr. C. W. Johnson has observed the same habit at St. Augustine, Fla., where he has noted them killing honey bees and bumble-bees. Charles Dury in "Random Notes on Natural History" (Jour. Cinn. Soc. Nat. Hist., Vol. XIX, No. 5, page 172) says: "In a field near Hyde Park this powerful robber fly was very abundant from June until October, 1899. Its favorite victims were Hymenopterous insects, mostly honey bees. I have several specimens taken in the act of killing bumble-bees larger than themselves; seventy specimens collected."

In Central Missouri, I took it feeding on scoliid and tiphia wasps, the honey bee, a large *cerceris* and, in one case, a large *polistes*, larger (longer at least) than the fly itself.

Mallophora bomboides Wiedemann. This large species is fairly common in Florida and along the sandy coastal strip as far north as Wilmington, N. C. It is found in the dry sandy scrub characteristic of this region, appearing in the late summer, a few being found in Southern Florida as late as January. It flies with a loud, deep buzz, alighting on the tips of shrubs or on the stalks of tall reeds. Its flight may be prolonged, and it frequently may be observed to zoom up into tree tops, presently returning to a resting place on the twig of a shrub nearer the ground. This species kills honey bees as well as the largest bumble-bees, carpenter bees and wasps. In Southern Florida, during a period when Hymenoptera were very scarce, I found it feeding on large beetles, reduviid bugs, and even grasshoppers.

Mallophora faultrix O. S. This fairly common western species, considerably smaller than *M. orcina*, but having also a bee-like habitus, has been taken in California feeding on honey bees.

Mallophora clausicella Macquart. This small, common, southern species is said by Mr. C. S. Brimley of Raleigh, N. C., to kill

honey bees. I have seen it preying on smaller solitary bees and do not doubt that it would be able to overcome the honey bee in spite of its size, which is less than that of the Hymenopteron. Such would be no more remarkable than the ability of its large relative *M. bomboides*, which I have taken feeding on a queen bumble-bee noticeably greater in bulk than its captor. McAtee and Banks (1920) recorded it as feeding on *Vespula germanica* and *V. vulgaris* and Banks (1913) took it with a bee, *Epeolus* sp.

Proctacanthus. The members of this genus are among the largest of our Eastern asilids. Probably all kill honey bees. Those definitely known to kill honey bees are *philadelphicus*, *rufus*, *milbertii*, and in the Far West, *occidentalis* and *arno*. The food predilections of our largest species, namely, the very rare *heros* Wiedemann found in the Southeastern States, are as yet unknown.

Proctacanthus philadelphicus Macquart is an abundant, late summer species in the Northeastern States, occurring as far south at least as North Carolina. It frequents dry fields and pastures where it flies up with a loud, sharp buzz taking an undulating course over the field until with a sharp turn it alights on a stone, dried patch of cow-dung or simply on the ground. The varying intonations of the buzz of one or two of these insects flying around within hearing of the observer suggest a mumbled conversation in the near distance, and it was evidently to this species that the late William Hamilton Gibson referred in his charming, popular books on nature as "The Talking Fly." Of about 300 prey taken from this species by the writer, more than two-thirds are Hymenoptera, with the honey bee well represented. Its favorite food seems to be worker yellow-jackets (*Vespa communis*, *diabolica*, and *vidua*) of which it destroys a great many. Worker bumble-bees of several species, the white-faced hornet, ichneumon flies, other Diptera, particularly other Asilids (including *Deromyia umbrina*, *D. misellus* and *Erax rufibarbis*) and small Coleoptera figure in the list of species taken, as do occasionally small grasshoppers.

Proctacanthus rufus Williston. This reddish species occurs in early and midsummer from Maine to Florida and Oklahoma, but its habitat is restricted to the sandy areas particularly along cer-

tain streams. In such places, it may be locally common. It is an active and wary species, generally alighting on the sand and is difficult to stalk and secure. Its prey seems to be pretty well restricted to Hymenoptera and honey bees figure as the largest item in the list of species that I have taken from it. It also captures numbers of *polistes*, other wasps, bumble-bees and even the white-faced hornet.

Proctacanthus milbertii Macquart. The "Missouri Bee-Killer." This is one of the largest and most widely distributed species of the genus. It ranges from Mississippi, Texas and New Mexico to Ohio and Virginia, northwest to British Columbia, and is a characteristic species of the prairies and the plains. I found it very abundant in dry fields in Missouri during the late summer. Although this species was recorded by Riley (1870) as a particular enemy of bees, my observations failed to bear this out. I obtained a large series of prey in Missouri and the vast majority were grasshoppers, butterflies and skippers. I did not take it with a single honey bee, although in many fields where it occurred, both *D. discolor* and *Mallophora orcina* were also present and feeding on honey bees. That it does on occasion take honey bees is certain, but I am inclined to classify this species as one that generally prefers insects of the "fluttering" type of flight rather than the "buzzing." Riley in later papers records it as an enemy of the Rocky Mountain locust and also of the cotton worm, and I believe that such insects figure much more in its menu than do honey bees. Walton (1914, p. 174) in New Mexico found it preying largely on immature grasshoppers. Davis (1919, p. 89) and Wallis (1913) have recorded its preying on cicindellid beetles.

Proctacanthus occidentalis Hine. This large, elongate species occurs on the dry prairies and mesas of California, Oregon, Washington and British Columbia, and possibly slightly eastward. On the one occasion I found an individual with prey, the victim was a worker honey bee.

Proctacanthus arno Townsend. I took this species in Southwestern Arizona feeding on an alfalfa butterfly, a large apio-cerid fly and a worker honey bee.

Erax. The only time I have taken a species of this genus with a honey bee as prey was on June 28, 1925, near Arlington, Ari-

zona, where I found a female *Erax pernicis* Coquillet resting on the side of a mesquite bush with a worker honey bee in its grasp.

Erax rufibarbis Macquart is a common species in the East and large enough to overcome honey bees, but I have never seen it capture one, although I have watched it closely in the field and disturbed bees on flower heads to make them fly in range of the asilid. In all cases, the fly paid no attention, even in the same field where *Proctacanthus philadelphicus* was seizing the bees at every opportunity. I have collected a great deal of food material from *E. rufibarbis*, but this has been composed mostly of other diptera, winged ants, small solitary bees, small butterflies, etc. I was quite surprised, therefore, to note in the North Carolina State collection at Raleigh, a specimen (female) with a worker honey bee as prey. The data on this specimen was Moncure, N. C., X, 6, 1921. T. B. Mitchell.

Erax interruptus Macquart is listed by Cook as a bee-killer (the name *Erax* only is given, but the picture identifies it in spite of the fact that the venation is incorrectly drawn). Here again, although I have tried to coax, in the manner above alluded to, the species to take bees, the effort was not attended with success. This species, abundant in most parts of the South from Virginia to Florida and Southern California, I have found to be partial to butterflies and grasshoppers, seizing individuals of the latter much larger than itself. It occurs in old fields, pastures and cultivated fields and has received several local common names, such as "fly-hawk," "path-finder" from its habit of alighting in paths through pastures and fields, and "Snorey Joe" from its sonorous buzzing. Under the name *Erax apicalis*, Comstock (1879) pictures and refers to it as an enemy of the cotton leaf worm, while Malley (1902) records it under the name *Erax lateralis* as feeding on the boll-worm adults. It is, I believe, from the standpoint of the feeding habits of the adult, one of our most beneficial as well as abundant and wide-spread Asilids.

While, therefore, it is possible that some species of *Erax* may occasionally feed on honey bees, the evidence points to their activities in this respect as being not at all comparable to the destruction caused by the major bee-killers, such as *Promachus* or *Deromyia*.

CONCLUSIONS

It may be surmised from the foregoing that robber flies can cause economic losses only where a certain combination of conditions exist. This demands a great abundance of a bee-killing species in the close vicinity of the apiary. Probably the only species in this country for which these conditions would obtain would be *Promachus fitchii* O. S., which might be sufficiently numerous in a field near an apiary to cause considerable damage. As it would occur in fields heavily infested with white grubs on which the larvæ feed, the obvious control would be to pasture the fields to hogs if this were practical. The latter would probably feed on and to a considerable extent rid the field of both white grubs and asilid maggots. Fall plowing of the infested fields might also be suggested as a control method.

BIBLIOGRAPHY

1915. ADAMS. Bulletin Illinois Nat. Hist. Survey, Vol. XI, Sept. 1915, p. 186.
1913. BANKS, N. Asilids Catching Hymenoptera. Proc. Ent. Soc. Washington, XV, p. 51.
1914. BROMLEY, S. W. Asilids and Their Prey. Psyche, XXI, p. 192-198.
1923. BROMLEY, S. W. Observations on the Feeding Habits of Robber Flies. Psyche, Vol. XXX, No. 2, p. 41-45.
1929. BROMLEY, S. W. The Asilidæ of Cuba. Annals Ent. Soc. Amer., Vol. XXII, No. 2, p. 272-295.
1923. CHAMPLAIN AND KNULL. Notes on Penn. Diptera. Ent. News, XXXIV, July, p. 212.
1879. COMSTOCK, J. H. Report on Cotton Insects, p. 172.
1894. COOK, A. J. The Bee-Keepers' Guide, Fifteenth Edition, p. 414-419, Geo. W. York and Company, Chicago, Ill.*
1922. COPELLO, ANDRÉS. Biología de *Mallophora ruficauda* Wied. Physis. vi. no. 21, p. 30-42, 2 pls. Buenos Aires.
1927. COPELLO, ANDRÉS. Biología de Moscardón cazador de abejas. Secretaría técnica No. 699. Ministerio de Agricultura, Buenos Aires.
1919. DAVIS, J. J. Contributions to a Knowledge of the Natural Enemies of Phyllophaga. Ill. Nat. Hist. Survey, Vol. XIII, Article V.
1900. DURY, CHARLES. Random Notes on Natural History. Jour. Cinn. Soc. Nat. Hist., Vol. XIX, No. 5, p. 172.
1913. FELT, E. P. Twenty-ninth Report of the State Entomology, 1913. Univ. State N. Y. Bulletin No. 589, April 15, 1915, p. 25-26.

* Thanks are due Mr. H. F. Ammidown, Southbridge, Mass., for the use of this volume loaned to me from his excellent library.

1864. FITCH, ASA. Ninth Report on the Noxious and Other Insects of New York State, p. 251.
1850. LE CONTE, L. Proc. Amer. Assoc. Meet. ii.
1920. MCATEE, W. L. and BANKS, N. Proc. Ent. Soc. Washington, Vol. 22, No. 2, p. 13-33.
1902. MALLEY, F. W. Report on the Boll Worm. Texas, p. 32, Sept.
1893. MARLATT, C. L. Proc. Ent. Soc. Washington, Vol. 2, p. 82.
1902. MARSHALL, G. A. K. Five Years' Observations and Experiments on the Bionomics of S. African Insects. Trans. Ent. Soc. London, p. 292-405.
1906. POULTON, E. B. Predaceous Insects and their Prey. Trans. Ent. Soc. London, Part III, p. 323-409.
1924. POULTON, E. B. The Relation between the Larvæ of the Asilid Genus *Hyperechia* and those of Xylocopid Bees. Trans. Ent. Soc. London, p. 121-133.
1869. RILEY, C. V. First Annual Report on the Noxious, Beneficial and other Insects of Missouri, p. 168.
1870. RILEY, C. V. Second Annual Report on the Noxious, Beneficial and other Insects of Missouri, p. 121.
1836. ROBINEAU-DESVOIDY. Notice sur un nouvel ennemi de l'abeille domestique. C. R. Acad. Sci., p. 689.
1925. SAREL-WHITFIELD, F. G. The Relation between the Feeding Habits and the Structure of the Mouth-parts in the Asilidæ. Proc. Zool. Soc. London, p. 599-638.
1868. THOMPSON, R. O. Rural World, Sept. 12.
1913. WALLIS. Canadian Entomologist, May, 1913, Vol. XLV, No. 5, p. 135.
1860. WALKER, F. Trans. Ent. Soc. London (2), p. 282 (*Trupanea*).
1914. WALTON, W. R. Report on Some Parasitic and Predaceous Diptera from N. E. New Mexico. Proc. U. S. Nat. Museum, Vol. 48, p. 171-186.
1922. WALTON, W. R. U. S. D. A. Farmers' Bulletin 747.
1905. WASHBURN, F. L. Tenth Annual Report of the State Entomologist of Minnesota, p. 86-88.

PLATE X

- Figure 1. *Promachus fitchii* O. S. The "Nebraska Bee-killer." Natural size.
- Figure 2. *Deromyia umbrina* Loew. A common "bee-killer" in New England. Natural size.
- Figure 3. *Mallophora ruficauda* Wied. The Argentine "Bee-killer." Natural size. Received from Dr. Andrés Capello.
- Figure 4. *Proctacanthus philadelphicus* Macq. A common "bee-killer" in the Northeastern States. Natural size.
- Figure 5. *Stenopogon* sp. with honey bee. A "California Bee-killer." Slightly enlarged.